

New 50mm Differential Expansion Transducer reduces installation

by **Mark Welch**
Marketing Associate
Bently Nevada Corporation

Differential expansion is an essential measurement for large steam turbines. During transient operation, such as at startup and during load changes, a turbine's rotor and case expand at different rates. If the difference in rotor axial expansion and case expansion is too large, the turbine's rotating and stationary components come into contact. The result is substantial machine damage.

A differential expansion monitoring system protects steam turbines from such damage. The system consists of a differential expansion monitor and transducer. The monitor issues a warning if the difference between rotor axial expansion and case expansion exceeds a predefined limit. The transducer measures the axial position of

the rotor relative to the case. The most accurate and reliable transducer with which to measure differential expansion is Bently Nevada's new 50 mm Differential Expansion Transducer.

Measuring differential expansion

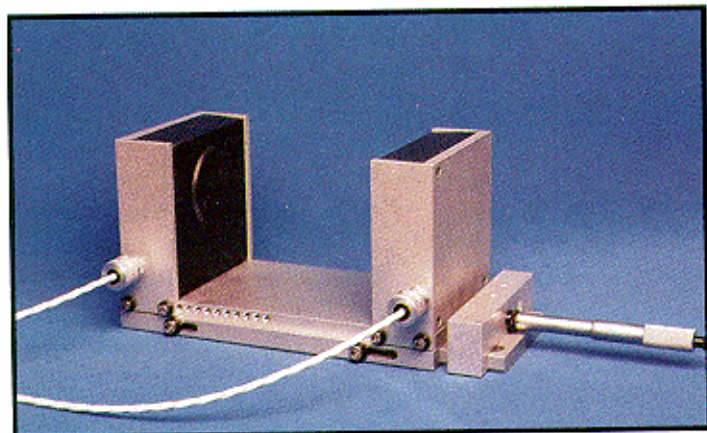
The difference between rotor axial expansion and case expansion is measured by one or more transducers that are mounted on the machine case and observe rotor axial motion. Differential expansion is typically measured at a point on the machine train where axial clearances are most critical. On many machines, it is measured at two or three different locations.

The case-mounted differential expansion probes commonly observe either a collar or a ramp on the turbine rotor. A single transducer of sufficient range can measure differential expansion by observing one side of a collar on the rotor (Figure 1). Two transducers observing the same side of the collar increase the system's reliability. If the differential expansion will exceed the transducer's range, two probes

installed in a complimentary input configuration - one on either side of the collar - double the measurement range (Figure 2).

Two differential expansion transducers are required to observe a ramp on the rotor (Figure 3). The ramp has two surfaces of equal slope, either facing or opposing each other. One transducer is mounted perpendicular to each ramp face. Signals from the two transducers are processed by a Ramp Differential Expansion Monitor, which converts the measurements to rotor axial movement. Overall range is not increased, as in the complimentary input configuration. Each transducer instead cancels the radial motion detected by the other, leaving only axial movement.

Our 50mm Differential Expansion Transducer is an accurate and reliable transducer for measuring differential expansion in applications that require a relatively large range. When measuring a collar, its range is from 12.5 to 27.9 mm (0.49 to 1.10 inches). It is the newest addition to our differential



50 mm Differential Expansion Transducer mounting bracket with probes in a complimentary input configuration.

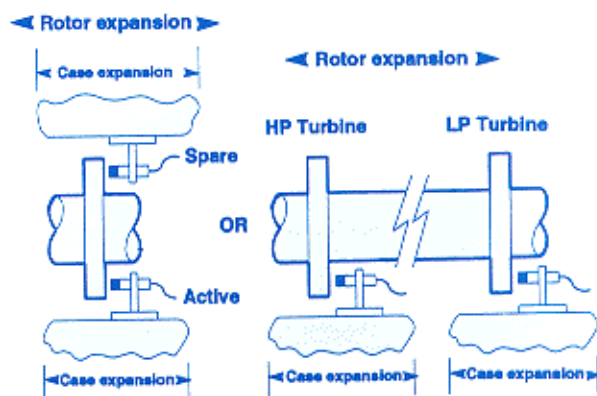


Figure 1
Differential expansion transducers observing a collar on a rotor.

Expansion Transducer and maintenance costs

expansion transducer line, which includes the 8mm, 11mm, 14mm, and 25mm transducer systems.

Easier verification

A differential expansion transducer's operation must be verified during installation, and periodically afterward. Its operation is verified by physically moving the transducer, to simulate shaft collar motion. The 50 mm Differential Expansion Transducer has an optional mounting bracket that makes verification easier and more accurate.

The optional mounting bracket has a sliding plate, on which the transducer mounts, and a base plate that attaches to the turbine case. The sliding plate slides on the base plate, making it easy to move the transducer for calibration and verification. The precisely-machined bracket aligns the transducer system perpendicular to the rotor. Mounting brackets are available for a single transducer, and for two transducers mounted in a complimentary input configuration.

A better transducer

Our new 50 mm Differential Expansion Transducer is very accurate, performs well on short collars and inhibits oil wicking. It is compatible with our differential expansion monitors and is simple to order.

More accurate

The 50 mm Differential Expansion Transducer is more accurate than our previous 50 mm probe because of its integral design. A differential expansion transducer system consists of a probe and a Proximity® sensor. Our new integral design combines the two in a single unit. The single unit eliminates interchangeability errors, which makes this transducer four times more accurate than our previous 50 mm probe. A built-in temperature sensor compensates the output signal over the wide range of -35 to $+120^{\circ}\text{C}$ (-30 to $+249^{\circ}\text{F}$). At turbine operating temperatures, the transducer's output is stable, for precise differential expansion measurements.

Better performance on short collars

The 50mm Differential Expansion Transducer has excellent performance on short collars. A built-in shield is installed in each transducer to reduce side-view of the rotor surface.

Non-wicking cable

The transducer's non-wicking cable inhibits oil from migrating through the cable and out of the machine. Armor, which protects the cable from damage, is also available.

Our new 50 mm Differential Expansion Transducer is fully compatible with the Differential Expansion Monitors in our 7200, 3300 and 3500 Monitoring Systems. It is easy to order, because the extension cable and Proximity® sensor are specified in the transducer's part number.

See the June 1995 issue of Orbit for more information on differential expansion monitoring. For more information on Bently Nevada's new 50 mm Differential Expansion Transducer, contact your nearest Bently Nevada sales and service representative. ■

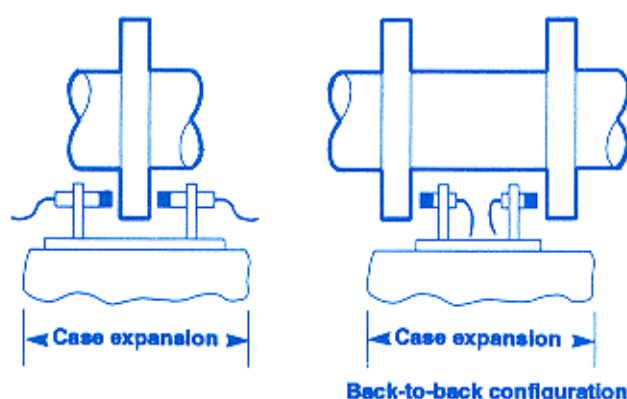


Figure 2
Differential expansion transducers observing opposite sides of a collar on a rotor.

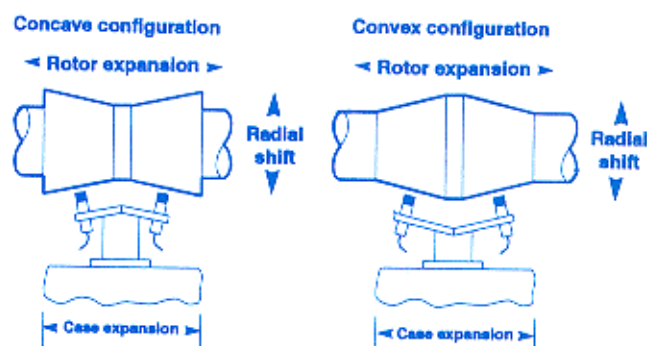


Figure 3
Differential expansion transducers observing a ramp on a rotor.